AESQ STRATEGY GROUP™
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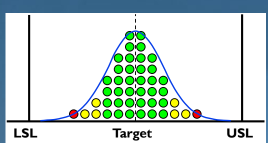
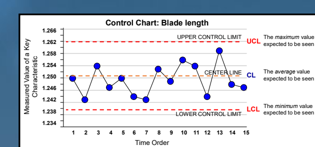
PROCESS CONTROL METHODS
WHAT IS RM13006?



Tools & Tips Webinar sponsored by the AESQ Process Control Methods SMIG

December 6, 2022



PROCESS CONTROL METHODS

Agenda – 60 minutes

Overview	Pete Teti – Pratt & Whitney
Who is the PCM Subject Matter Interest Group	Pete Teti- Pratt & Whitney
Why this webinar? Where can we find help?	Pete Teti- Pratt & Whitney
PCM Community of Practice – Linked In	Pete Teti – Pratt & Whitney
A Walk Through RM13006	Nicklas Godebu – GKN Aerospace
Case Studies	Nicklas Godebu – GKN Aerospace
Interaction with other AESQ reference manuals	Nicklas Godebu – GKN Aerospace
Red Flags to look out for	Nicklas Godebu – GKN Aerospace
Q&A	Team
Summary and Close	Pete Teti – Pratt & Whitney

PROCESS CONTROL METHODS OVERVIEW

FELLOW, QUALITY ENGINEERING
PRATT AND WHITNEY

KEY POINTS
- Who is the AESQ Subject Matter Interest Group
- A walk through RM13006
- What is the PCM Community of Practice
- Summary of the Nine Process Control Methods

WEBINAR OVERVIEW

We are **recording** today's webinar and will distribute the video link following the close of the webinar. It will also be posted on the AESQ website for free viewing.

We will take **questions** during today's webinar using the **Chat** feature.

Please remain on Mute during the presentation to prevent background noise. We will also be muting all lines at the start of the session.

PROCESS CONTROL METHODS

Why this webinar?

Communicate the purpose of the RM13006 document and its importance to AS13100

Describe how RM13006 interacts with other AS13100 reference manuals

Promote the available free documents and tools that can be used by any AESQ supplier

Answer questions suppliers may have about process control methods

PROCESS CONTROL METHODS PER RM13006
Purpose of this reference manual

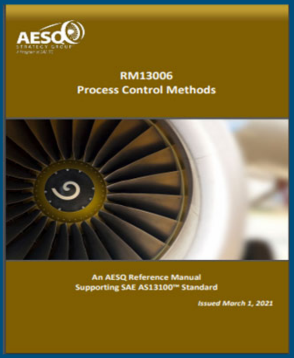
RM13006 provides the user with an array of practical approaches to process control used to ensure consistent product quality.

The purpose of this reference manual is to raise the overall capability of the aerospace engine supply chain, standardize the process control requirements across AESQ suppliers, and build on the requirements for PFMEA and Control Plans (ref. RM13004).

SAP0

RM13006 supports AS9145 - Requirements for Advanced Product Quality Planning and Production Part Approval Process, and AS9103 - Variation Management of Key Characteristics, supported by detailed guidance and case studies.

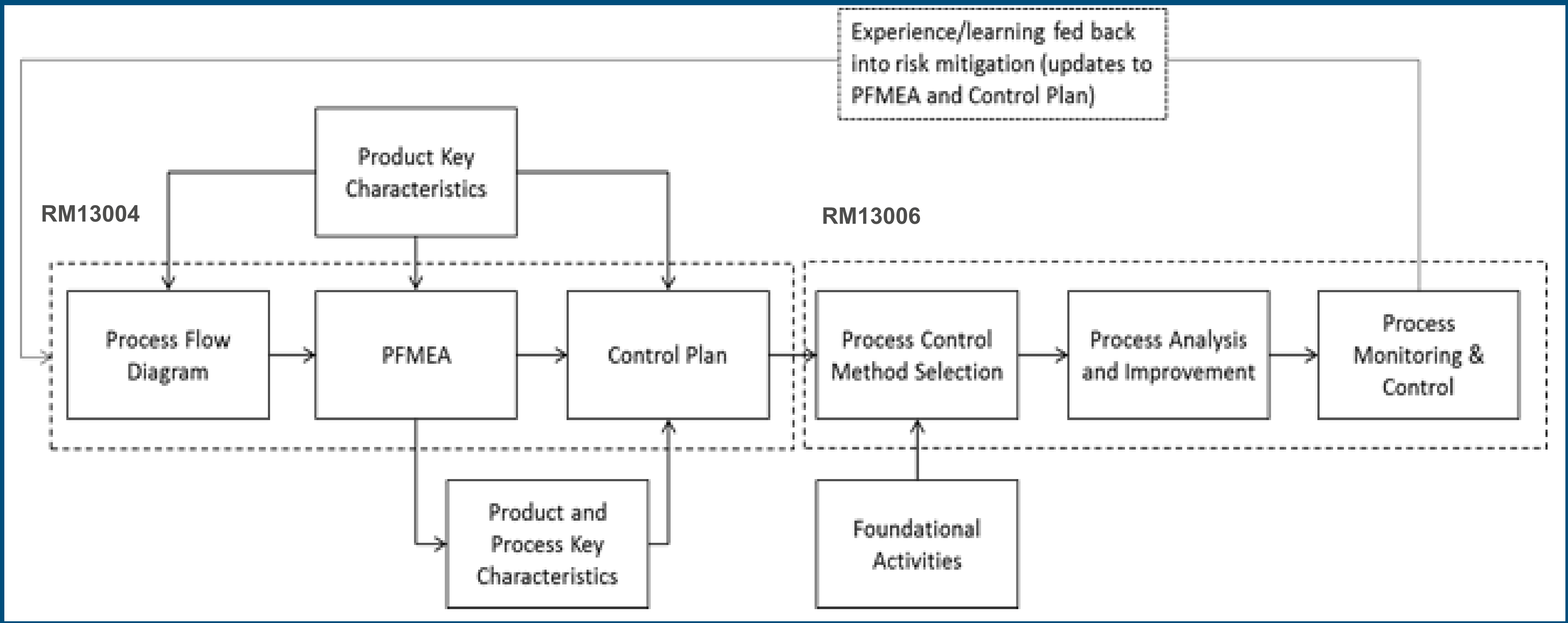
This reference manual was developed by a dedicated team from AESQ member companies with expert knowledge and experience in the areas of process control, process improvement, quality systems, and supplier engagement.



SAP0 The title of RM13004 is "Defect Prevention Quality Tools to Support APQP & PPAP", but that's rather long. Could be shortened to ""Defect Prevention Quality Tools"

Stout, Andrew PWC, 2022-12-01T16:08:43.113

INTERFACE WITH PFMEA AND CONTROL PLANS

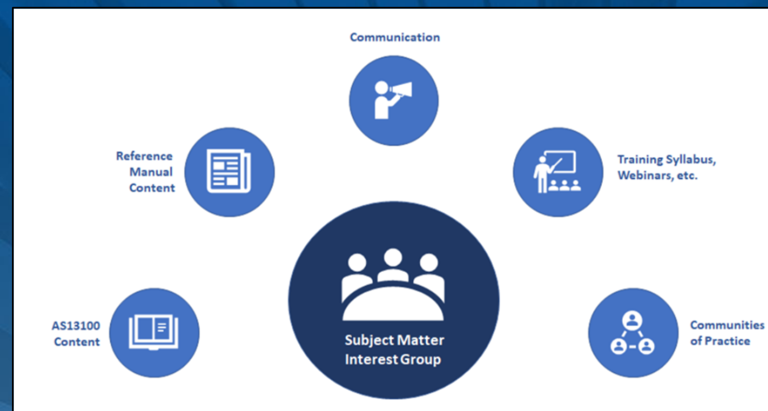


Process Control Methods follows the risk identification and mitigation activities described in RM13004, PFMEA and Control Plans

PROCESS CONTROL METHODS SUPPORT

What is the Process Control Methods SMIG Group?

- The purpose of the PCM Subject Matter Interest Group is to promote the effective deployment of the process control methods across the AESQ Supply Chain.
- The Group is made up of Subject Matter Experts from the AESQ Member Companies.
- The Group is accountable for the AS13100 related Requirements and associated Reference Manual content, ensuring that it is up to date and reflects current knowledge and best practice.
- It shall promote the effective deployment of the Reference Manual using Communities of Practice (CoP). The CoP is open to anyone with an interest in process control from the AESQ Member Companies and the wider AESQ supply chain.
- Activities may include webinars, best practice sharing, development of shared training materials, conferences and published papers.



NO.	FUTURE WEBINAR TOPICS	TARGET DATE/TIME
1	Process Control Methods - What is RM13006? Interaction with other AESQ Reference Manuals	12/6/2022 (11 AM US Eastern)
2	What makes a good Process Capability Study?	1/26/2023 (11 AM U.S. Eastern)
3	Process Capability Study for True Position (handling MMC)	2/8/2023 (11 AM U.S. Eastern)
4	The use of non-statistically based process control methods	2/15/2023 (11 AM U.S. Eastern)
SAP0	The Power of Precontrol	3/8/2023 (11 AM U.S. Eastern)
6	The One-Hour Process Control Assessment	4/11/2023 (11 AM U.S. Eastern)
7	Why is statistical control a prerequisite for process capability?	Target 2nd Qtr (May)
8	Dealing with Non-Normal Data	Target 2nd Qtr (June)
9	Conducting capability studies for one-sided geometric tolerances	Target 3rd Qtr (July)

https://aesq.sae-itc.com/interest-groups

Slide 8

SAP0 Is it mandatory to be a SME to attend?
Stout, Andrew PWC, 2022-12-01T14:43:17.613

TPEP0 0 Revised
Teti, Peter E , 2022-12-01T17:38:51.671

TPEP0 1 This was original wording from the AESQ SMIG website but I changed it.
Teti, Peter E , 2022-12-01T17:39:21.317

SUBJECT MATTER INTEREST GROUPS

Who is the Process Control Methods SMIG Team?

Pete Teti
PWA
(Leader)

Andrew
Stout
PWC
(Co-Lead)

Nicklas
Godebu
GKN

Paul Gorg
PCC

Rudi
Braunieder
MTU

Karen
Scavotto
PWA

Steve
Hampton
PCC

Douglas
Dush
Honeywell

Grant
Braun
PCC

Geoffrey
Carpentier
Safran

Marnie
Ham
GE

Shailesh
Shinde
RR

Curator for RM13006

Experts who you may address process control related question to

Provider of process control related webinars. See Slide 23 for webinar schedule which is subject to change based on your feedback

SAP0

Slide 9

SAP0 It's on the previous page.
Also wording could be improved.
Stout, Andrew PWC, 2022-12-01T14:44:29.606

TPEP0 0 Yikes!! That was supposed to be deleted!! Thanks! I deleted the paragraph.
Teti, Peter E , 2022-12-01T17:40:30.356

TPEP0 1 I actually reworded it and referenced Slide 23 that contains the schedule.
Teti, Peter E , 2022-12-01T17:42:12.781

PROCESS CONTROL METHODS COP

Where to get help

AESQ Supplementary Materials webpage for a copy of RM13000 and supporting templates

https://aesq.sae-itc.com/supplemental-material

Subject Matter Interest Group – meets monthly – supports continuous improvement of RM13006 and supporting templates & tools

AESQ Process Control Methods Community of Practice (COP) on Linked-In

Current membership is 200 – let's get some more!!

https://www.linkedin.com/groups/12647920/

A WALK THROUGH RM13006

NICKLAS GODEBU
INDUSTRIAL ENGINEER
GKN AEROSPACE ENGINE SYSTEMS

<u>KEY POINTS</u>
- Table of Contents
- Case studies
- Training syllabus
- Red Flags

TABLE OF CONTENTS

Highlights

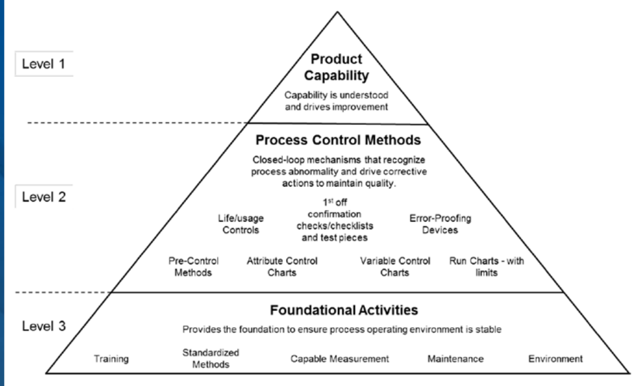
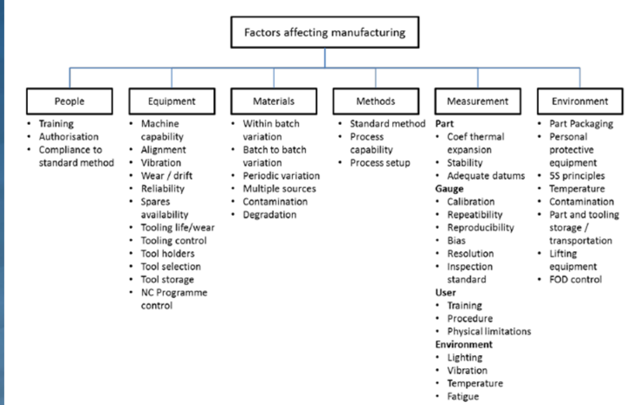


Figure 5 - Process Control Overview



RECOGNIZED PROCESS CONTROL METHODS
Purpose of this reference manual

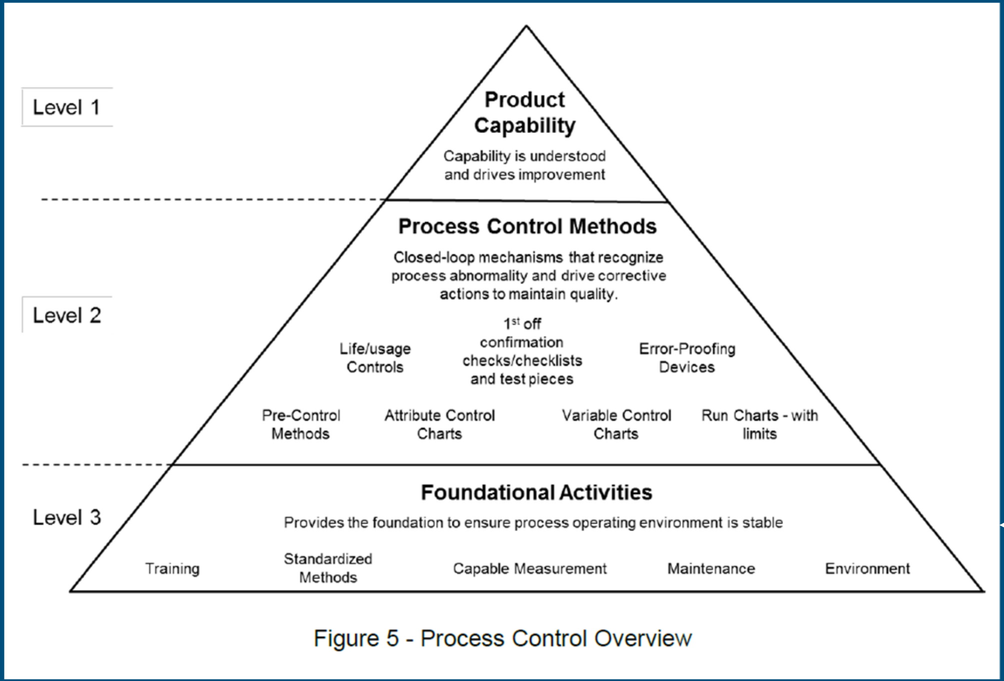
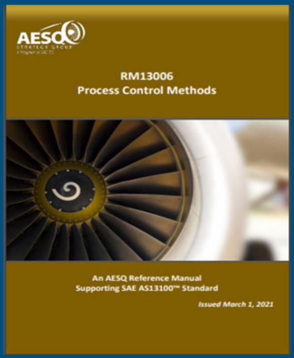


Figure 5 - Process Control Overview



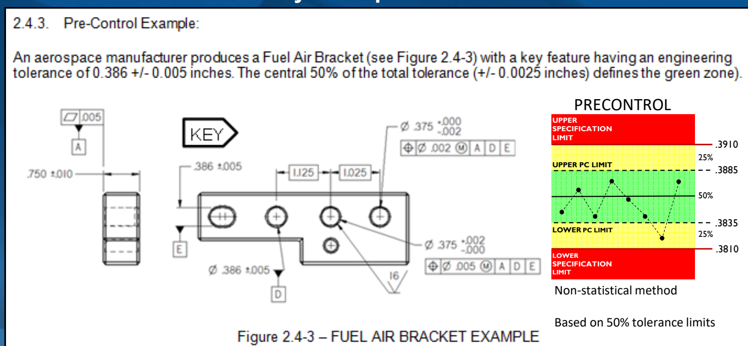
Pyramid Diagram extracted from RM13006, Figure 5, Page 9

Process Control has three main facets that are: Product Capability, Process Control Methods and Foundational Activities. High performance is not achievable without all three elements being in good order.

EXAMPLES AND CASE STUDIES

Real-life examples are used to facilitate understanding and provide guidance in areas that are typically found in a textbook.

Case Study Example - PreControl



2.4.3. Pre-Control Example:

An aerospace manufacturer produces a Fuel Air Bracket (see Figure 2.4-3) with a key feature having an engineering tolerance of 0.386 +/- 0.005 inches. The central 50% of the total tolerance (+/- 0.0025 inches) defines the green zone).

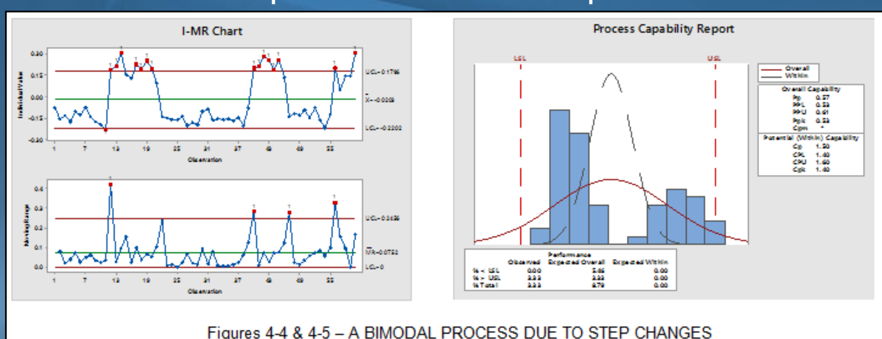
Figure 2.4-3 – FUEL AIR BRACKET EXAMPLE

Guidance Table Example

Table 2.6-1 – ATTRIBUTE CONTROL CHARTS

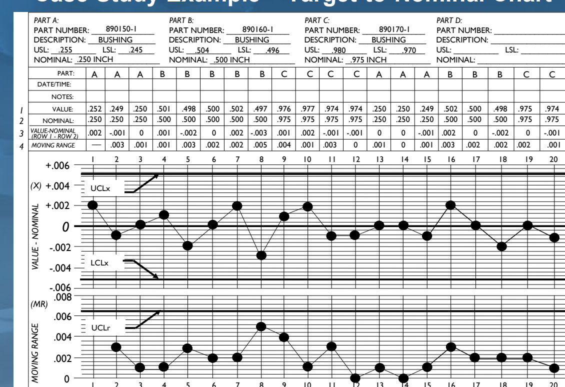
Scenario	When to use	Control type (which chart)	Example
A process that observes discrete values, such as pass/fail, go/no-go, present/absent, or conforming/ non-conforming. For example a circuit card could consist of a number of solder joints that either conform or do not conform to a set standard	Appropriate: When it is important to control the number or % of defects over a given time period, lot to lot, or unit to unit such as measuring improvement over time, when go/no-go gauges are employed or when visual inspections are used. Not Appropriate: Cannot be used for establishing process control or process capability in the same way as variables data	**P-chart** Plot the percent defective – classifying product as good or bad with changing or constant subgroup size	Plot the monthly percent defective rate of a critical supplier; plot the On Time Delivery performance of a critical supplier
		NP-chart Plot the number defective – classifying parts as good or bad with constant subgroup size	A machining cell produces fuel control valves in standard lot sizes of 50. Final Inspection performs a 100% inspection of the product and plots the number of valves that are determined to be nonconforming.

Specific Control Method Example



Figures 4-4 & 4-5 – A BIMODAL PROCESS DUE TO STEP CHANGES

Case Study Example – Target-to-Nominal Chart



Control of multiple part numbers on one chart

Similar configuration, machine, and tolerances

Process Control vs Part Control

Slide 14

SAP0 "from" should be removed.
Stout, Andrew PWC, 2022-12-01T14:47:48.156

TPEP0 0 Great catch!! Revised as suggested.
Teti, Peter E , 2022-12-01T17:43:31.725

RM13006 TRAINING SYLLABUS

Details the minimum content that a Process Control Methods training syllabus needs to contain to support continued competence in the application of this standard

Partial syllabus shown

Refer to Appendix C for the full training syllabus

Table 1 – Training Syllabus

THEME	OUTCOMES	MINIMUM CONTENT
The importance of Process Control	Appreciation of customers' needs and the benefits to the organization, industry and society Learning Objective: Learner will be able to describe the importance of process control including how it benefits company, industry, and society.	• Examples and discussion on process control failures • Reputational impact • Effect on the Aerospace industry • Benefits of achieving design nominal (Taguchi's Loss Function) • Understanding and importance of a closed loop control system • Effectiveness of in process control over end-of-line inspection
Process Control in Context of Quality Planning	Understanding of the linkages between the quality planning activities Learning Objective: Learner will be able to explain the purpose of Control Plans, what they contain, and their use in developing work instructions. Learning Objective: Learner will be able to describe how Control Plans link to Process FMEA.	• Linkage between PFMEA, Control Plans, and work instructions • Purpose and content of a Control Plan

RM13006 APPENDIX C FOCUS AREAS

- The importance of Process Control
- Process Control in context of quality planning
- Selection of Process Control Methods
- Data Collection
- Process Capability Analysis
- Basic Root Cause Analysis and Process Improvement
- Application of Control Charts
- Error-Proofing

SAP0

Slide 15

SAP0 Suggest to remove this bullet
Stout, Andrew PWC, 2022-12-01T14:53:01.041

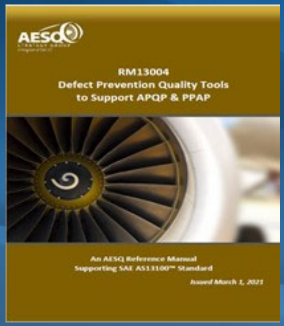
TPEP0 0 Deleted!!
Teti, Peter E , 2022-12-01T17:44:07.347

The Reference Manual Interactions

Process Control Methods (RM13006) will interact with failure mode and cause identification (RM13004), which includes sources of human error (RM13010), and root cause investigations (RM13000)

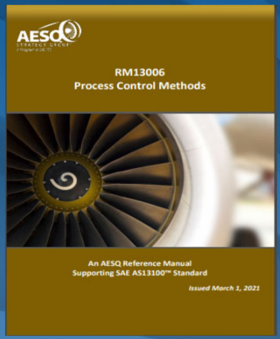
RM13004
PFMEA & Control Plans

SAP0



Proactive

RM13006
Process Control Methods



Reactive

Proactive

RM13010
Human Factors

Reactive

RM13000
Problem Solving Methods

Identify failure modes and causes (risk identification & mitigation)

SAP1

Identify and implement preventive and detection based controls

Look for sources of human error as part of root cause investigation

Identify root causes and corrective actions when conducting an investigation for customer, supplier or internal escapes & defects

SAP2

Failure modes, causes and controls that were not initially anticipated are feed back to the PFMEA and Control Plan

Slide 16

SAP0 Current RM title is "Defect Prevention Quality Tools to Support APQP & PPAP" - rather long, perhaps just the first part "Defect Prevention Quality Tools"
Stout, Andrew PWC, 2022-12-01T14:59:36.896

TPEP0 0 I was aware of the title but am trying to show the relationship of PCM following the use of PFMEA and Control Plans. I'll point out in the presentation what the actual title is.
Teti, Peter E , 2022-12-01T17:45:55.838

SAP1 I believe it's much broader than just "Identify failure modes and causes". How about "Identify high risk areas and mitigate" or something like that.
Stout, Andrew PWC, 2022-12-01T15:03:31.795

TPEP1 0 Want to link process control methods to failure modes and their causes as it follows in an actual PFMEA spreadsheet. Will keep as written.
Teti, Peter E , 2022-12-01T17:47:14.148

SAP2 Only to escapes?
Stout, Andrew PWC, 2022-12-01T15:05:59.841

TPEP2 0 Rewritten to be broader. Great catch!
Teti, Peter E , 2022-12-01T17:49:10.702

SAP7

WHAT QUESTIONS TO ASK WHEN ASSESSING A PROCESS CONTROL SYSTEM

Some things to look out for

Process Flow Diagram with KC's identified (where produced/inspected)

PFMEA with KC's accounted for

Control Plan accounting for all KC's and other high-risk areas

Gage Capability Studies for gages used to measure KC's

Use of non-statistical methods such as error proofing devices for high-risk areas

Use of Control CharSAP1r KC's at point of manufacturing

Is a process control subject mSAP3 expert SAP2taff (e.g., Six Sigma GB/BB or CQE)

How an operator responds to an out-of-control condition

Evidence of process control training

Use of process control data by company's engineering department SAP4

ASK THE KEY QUESTIONS

SAP5 SAP6 SAP

1. ave product risks and mitigation plans en identified?
2. Have KCs been identified to help address design risks?
3. Has a detailed process flow map been created?
4. Has a PFMEA been conducted by a cross-functional team and have high risk items been addressed?
5. Has a control plan been initiated?
6. Have MSA studies been completed and shown to be acceptable?
7. Has an initial assessment of statistical control & capability been performed?
8. Have process improvements been identified, implemented and verified so KCs are in statistical control with capability ≥ 1.00?
9. Has process map, PFMEA and control plan been updated to reflect process improvements?
10. Have KCs demonstrated a sustained capability ≥ 1.33?
11. Has a self-audit plan been implemented to include process control (r M checklist in Appendix A)? SAP9

SAP0 Would be good to indicate where this comes from in the RM - is it Appendix A - PCM Assessment Checklist? Doesn't seem to be.
Stout, Andrew PWC, 2022-12-01T15:08:46.385

TPEP0 0 It is something I came up with. The questions are from our ProCert Interactive Tool. The audit checklist does reflect many of these items I believe.
Teti, Peter E , 2022-12-01T17:50:32.274

SAP1 Control should be removed as it's in SPC
Stout, Andrew PWC, 2022-12-01T15:14:23.805

TPEP1 0 I removed "SPC" instead as I want to emphasize the use of Control Charts.
Teti, Peter E , 2022-12-01T17:51:28.671

SAP2 i.e. should be e.g. as it's not limited to just those.
Stout, Andrew PWC, 2022-12-01T15:19:19.847

TPEP2 0 Changed it to e.g
Teti, Peter E , 2022-12-01T17:52:02.164

SAP3 "process control engineer" is not used in the RM. The term "engineer", at least in Canada, is controlled by professional engineering associations. How about "expert" as in subject matter expert.
Stout, Andrew PWC, 2022-12-01T15:20:17.110

TPEP3 0 Changed to "process control SME"
Teti, Peter E , 2022-12-01T17:52:47.518

SAP4 The term "discipline health" is not used in the RM.
Stout, Andrew PWC, 2022-12-01T15:38:22.608

TPEP4 0 Removed "as part of DH"
Teti, Peter E , 2022-12-01T17:53:47.787

SAP5 "Use of process control data by company’s engineering department" is not mentioned in the RM. Many build to print supplier won't have an Engineering department.
Stout, Andrew PWC, 2022-12-01T15:39:33.810

TPEP5 0 In that case it would not be applicable to a BTP supplier. But for DRA suppliers it is an important item to ask about.
Teti, Peter E , 2022-12-01T17:54:41.061

SAP6 "product risks and mitigation plans" is under RM13004.
Stout, Andrew PWC, 2022-12-01T15:41:09.149

TPEP6 0 That's OK. There is an interaction between these two RM's.
Teti, Peter E , 2022-12-01T17:55:33.230

SAP7 "Have KCs been identified to help address design risks?" Is this covered in RM13006? No mentioned of "design risk"
Stout, Andrew PWC, 2022-12-01T15:43:20.109

TPEP7 0 Process control is a subject wider than RM13006. We are showing interconnectivity.
Teti, Peter E , 2022-12-01T17:56:43.465

SAP8 Aren't points 3, 4 and 5 are more applicable to RM13004? Although there certainly is some overlap.
Stout, Andrew PWC, 2022-12-01T15:46:16.854

TPEP8 0 Process control is a subject wider than RM13006. We are showing interconnectivity.
Teti, Peter E , 2022-12-01T17:56:52.725

SAP9 "Self audit" is not mentioned in the RM. Perhaps "PCM Assessment Checklist, per appendix A.
Stout, Andrew PWC, 2022-12-01T15:51:11.389

TPEP9 0 Revised to include PCM Checklist.
Teti, Peter E , 2022-12-01T17:58:02.926

THE NINE PROCESS CONTROL METHODS AND THEIR REACTION PLANS

PETER E. TETI
FELLOW, QUALITY ENGINEERING
PRATT AND WHITNEY

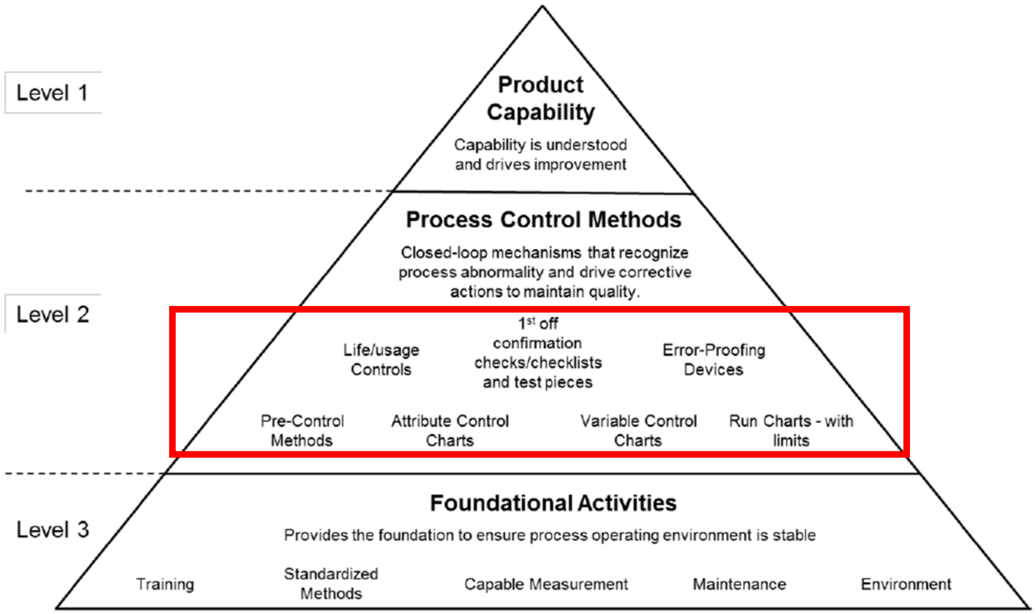


Figure 5 - Process Control Overview

THE NINE PROCESS CONTROL METHODS AND THEIR REACTION PLANS

PURPOSE

- To provide Suppliers guidance on the selection of Process Control Methods
- What each control method's reaction plan should look like

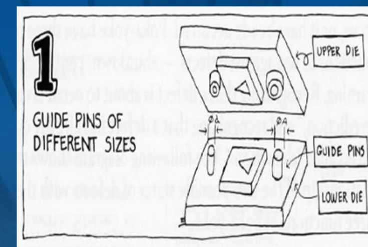
BACKGROUND

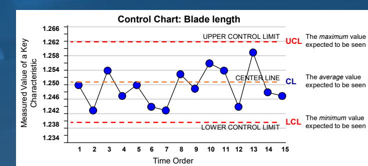
- The Reaction Plan, the last column on a Process Control Plan is commonly misunderstood
- Often, the assumption is a nonconforming part is generated driving the user to create an operator Reaction Plan that requires the operator to utilize the local MRB procedure
- PCP reaction plans should align to the identified control method
- If the process control signals the operator they've entered an error state, the reaction plan needs to instruct the Operator on what to do

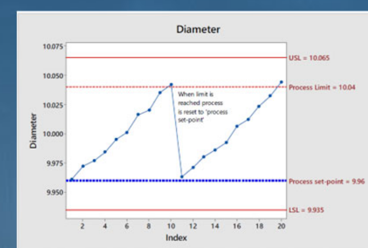
The best process control methods avoid the error state of making mistakes and subsequent defective parts; Reaction plans are the response to the control method signal

TABLE 1 - RM13006 PROCESS CONTROL METHODS

NO.	CONTROL METHOD	APPLICATION	EXAMPLE	PCP REACTION PLAN
1	**Error / Mistake Proofing**	To avoid defects caused by inadvertent errors. The most robust and preferred method. Mistake Proofing devices build quality into a process in order to prevent and/or detect errors prior to defects being made.	● One-way fit of a die insert to prevent mis-orientation during loading. ● Use of a physical device to prevent installation of an oil-fill tube into the wrong port.	● Level I M/P device prevents the possibility of entering an error state so no reaction plan is required. ● Level II devices such as alarms and buzzers require the operator to stop and investigate the error cause. This reaction may lead to following a precribed recovery plan that eliminates the error condition or at least to contact their M.E. and/or supervisor for the next steps to take.
2	**Variable Control Charts**	To monitor a process input or process outputs that is continuous in nature for the purpose of establishing and maintaining a state of statistical control (statistical stability).	● Dimensional product features are plotted on control charts at the point of process and monitored by the operator. The operator takes action to investigate and remedy issues when special causes are detected. ● The pressure drop in a vaccum furnace is monitored on a control chart to warn of developing issues. The operator responds to special causes by performing equipment diagnostic checks.	Variable Control Charts will send signals to the operator in the way of unusual/non-random patterns displayed by the data. These are known as the Western Electric Rules. Operators using control charts should have a laminated copy of these rules at their workstation, stop the job if any of these patterns are displayed on the control chart, take the appropriate action to bring the process back into statistical control. The operator may also decide to seek help from their M.E. and/or supervision.
3	**Run Charts with Non-Statistical Limits**	To monitor process inputs that require adjustment within acceptable operating limits in response to natural drift.Likely to be used when statistical limits offer little practical benefit or lead to false signals of special cause. To control conditions that follow a specific 'profile' during the operation of the process.	● The viscosity of the slurry used in an investment casting process is monitored. When a limit is reached, the operator adds water to the mixture to correct for evaporation over time. ● A highly capable genral toleranced characteristic on a machined part where tool wear is expected and can be tolerated to a point to maximise its effective use. The operator changes the tool at a predetermined dimension before the dimension becomes nonconforming. ● Furnace run charts tracking thermocouple temperature levels throughout a cycle for heat treat and brazing processes. Each point in the cycle will have a normal 'operating window' beyond which investigation occurs. Most likely to use an IT system linked to the equipment.	Run Charts may have "warning limits" applied that may have been determined by taking 50% or 75% of the engineering tolerance. While these limits may not be statistically determined, the reaction plan is similar to the ones used for Variable & Attribute Control Charts. The signal isn't so much an unusual pattern but approaching the warning limits that trigger the operator to stop and investigate what action to take. The operator may also decide to seek help from their M.E. and/or supervisior.



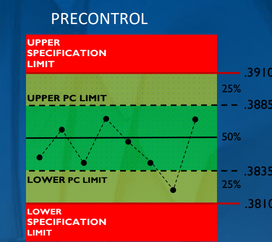




Process Control Methods Table continued on next page

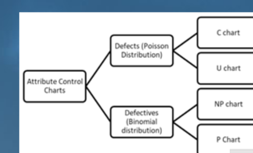
TABLE 1 - RM13006 PROCESS CONTROL METHODS

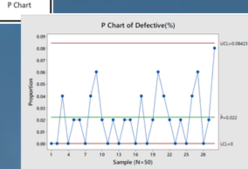
NO.	CONTROL METHOD	APPLICATION	EXAMPLE	PCP REACTION PLAN
4	**PreControl Charts**	To keep a capable process on target when the process either have a tendency to move from the nominal value. The process is not sensitive to small changes and statistical stability offers little benefit. When simple operating rules are beneficial	● Qualification that set-up of a fuel control valve grinding process is done by running the process and making adjustment until process is centred. Once centred the process is monitored and only adjusted when pre-control rules are broken. ● Monitoring of the outside diameter of an air cycle machine shaft where the operator controls adjustments by use of a machine offset in response to signals on the pre-control chart.	Pre-Control Charts have "warning limits" based on establishing an Upper PreControl and Lower PreControl Limit that represent 50% of the engineering tolerance. While these limits may not be statistically determined, the reaction plan is similar to the ones used for Run Charts with Non-Statistical Limits. The signal isn't so much an unusual pattern but approaching the PreControl limits that trigger the operator to stop and investigate what action to take. The operator may also decide to seek help from their M.E. and/or supervisior.
5	**Life / Usage Control**	Processes that degrade over time where the useful life/usage is known. Limits to operation (Time or number of cycles) will be set conservatively to avoid non-conformance.	● A forging die is running for a predetermined number of cycles (or number of predetermined pieces monitored by a counter) before being removed for refurbishment/disposal. The life and die change is managed to coincide with batch changes. ● Cutting tools with known wear characteristics are run for a specific cutting time. The life is monitored by recording operation to a Baluff chip and the life control is set up in the CNC program to prevent overuse.	● The operator will be provided a signal by a part and/or machine cycle counter. The reaction is to inform 1st line supervision that the die will need to be inspected and/or replaced per the line procedure. ● Cutting tool wear may be accounted by tracking a predetermined number of pieces using a counter, Run Chart w/o statistical limits, control chart or PreControl Chart. Once achieved, the reaction plan will be to replace the subject tool
6	**Attribute Control Charts**	For the monitoring of quality levels of product/process attributes where the output is based on counts (typically defects) or classification (typically defectives). Used for recognising changes in quality level due to special causes of variation	● Inspectors counting solder defects on a printed circuit board (PCB) use a system that monitors the average number of defects per PCB. If a special cause is detected the soldering process owner is informed and investigates the cause of the issue. The charts are reviewed by the operations management to identify opportunities for improvement and results of improvement initiatives.	Attribute control charts will send signals to the operator in the way of unusual/non-random patterns displayed by the data. These are known as the Western Electric Rules. Operators using control charts should have a laminated copy of these rules at their workstation, stop the job if any of these patterns are displayed on the control chart, take the appropriate action to bring the process back into statistical control. The operator may also decide to seek help from their M.E. and/or supervisior.



Non-statistical method

Based on 50% tolerance limits

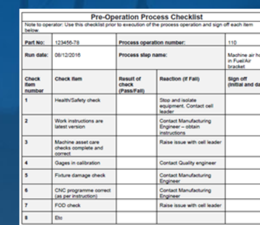




Process Control Methods Table continued on next page

TABLE 1 - RM13006 PROCESS CONTROL METHODS

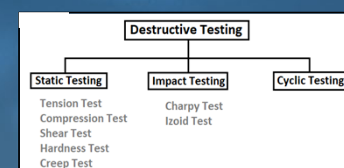
NO.	CONTROL METHOD	APPLICATION	EXAMPLE	PCP REACTION PLAN
7	**Visual Process Check and Checklist**	Checking a process attribute against a known standard and recording it as conforming (before allowing a process to run, or during a process run).	● A forging die is periodically examnined by an operator for evidence of damage, wear or scoring. The operator uses a checklist to record that the check has been conducted, and the result of the check. ● An operator of a process with a lengthy setup operation uses a checklist to confirm each step of an operation is completed before running the machine. The checklist may also include safety items.	Reaction Plan for the operator when a visual process check and/or set-up checklist illustrates a issue to a known standard, and/or checklist requirement, will be to correct, if possible, the nonconformance prior to running the job. Otherwise, the operator shall inform 1st line supervision and/or M.E. to aid in a corrective action.
8	**First Piece Check**	To validate the set-up and quality of a process prior to the full production run.	● A CMM check of the first part in a batch of parts off a press is performed following change of press tooling. If the part meets the requirements the process is controlled using other control methods in the process.	If the first piece check inspection reveals a nonconformance, the inpsector shall inform the first line supervisor, M.E., and producing operator. Following will be an investigation of the set-up and set-up procedure used to identify the cause of the first piece rejection.
9	**Test Piece evaluation**	Commonly used along with process parameter control to provide validation of product quality. Typically a destructive examination. NOTE: A destructive examination processed with a batch of material is more inspection than control; so needs to be used along with effective process input control.	● A piece of test material processed along with a batch of carburized gears in a heat treatment cycle is tested in a laboratory. ● Tensile strength destructive examination of a test speciman used in a heat exchanger vacuum braze process.	For a test specimen that does not meet specifications upon the test conducted, the reaction plan will instruct the test operator to contact the appropriate engineer (e.g., Materials, Quality or Manufacturing Engineer) who will investigate the process parameter inputs, furnace run schedule, etc. as for clues to why the test specimen failed to meet the test.



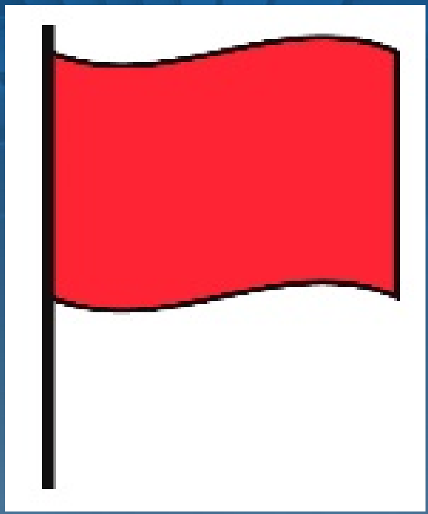
Pre-Operation Process Checklist

Note to operator: Use this checklist prior to execution of the process operation and sign off each item below.

Part No:	123456-78	Process operation number:		110
Run date:	08/12/2016	Process step name:		Machine air holes in Fuel/Air bracket
Check item number	Check item	Result of check (Pass/Fail)	Reaction (If Fail)	Sign off (Initial and date)
1	Health/Safety check		Stop and isolate equipment. Contact cell leader	
2	Work instructions are latest version		Contact Manufacturing Engineer – obtain instructions	
3	Machine asset care checks complete and correct		Raise issue with cell leader	
4	Gages in calibration		Contact Quality engineer	
5	Fixture damage check		Contact Manufacturing Engineer	
6	CNC programme correct (as per instruction)		Contact Manufacturing Engineer	
7	FOD check		Raise issue with cell leader	
8	Etc			



RED FLAGS TO LOOK OUT FOR



NICKLAS GODEBU
INDUSTRIAL ENGINEER
GKN AEROSPACE ENGINE SYSTEMS

RED FLAGS

SAP1

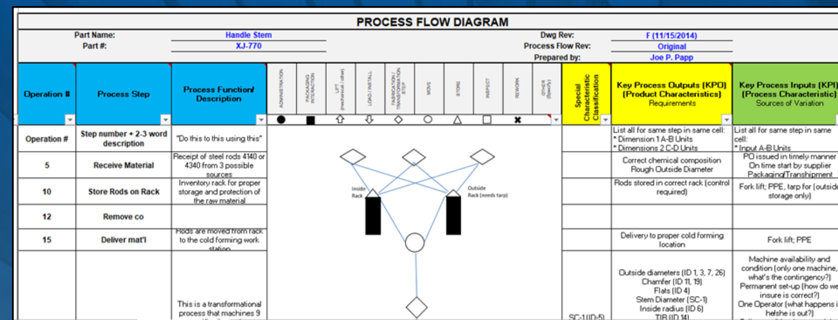
PROCESS FLOW DIAGRAM – RM13004

SAP2

Process Flow does not link or correlate with job router/traveler/shop order

SAP0

Not accounting for multiple stations where process step may be performed; control system may be different depending where the process step is run



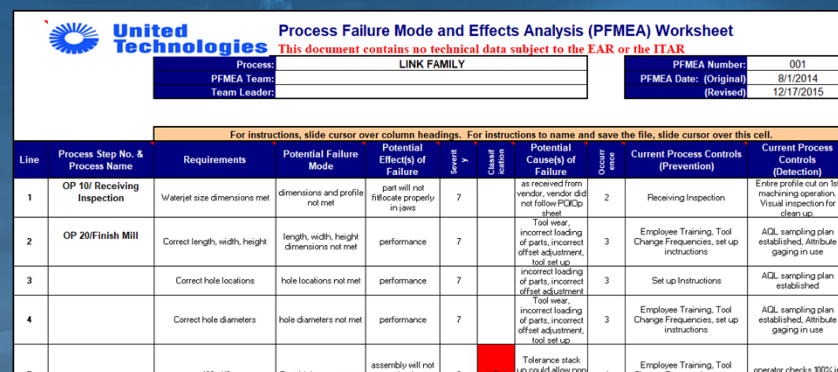
PFMEA – RM13004

PFMEA documents are dated even when changes to process plan have occurred

Failure modes and causes are combined making it hard to determine the control strategy

Misalignment between requirements, failure modes, causes and controls

No Supplier self-identified KC's



Slide 24

SAP0 Job router / traveler / shop order etc.
Stout, Andrew PWC, 2022-12-01T15:54:54.330

TPEP0 0 Revised as requested
Teti, Peter E , 2022-12-01T17:58:44.730

SAP1 I don't see the term "red flags" in the RM. Is there a plan to add them?
Stout, Andrew PWC, 2022-12-01T15:56:12.083

TPEP1 0 We probably should. Not everything being presented has to be out of the RM.
Teti, Peter E , 2022-12-01T17:59:23.670

SAP2 Shouldn't we focus this webinar on RM13006?
Stout, Andrew PWC, 2022-12-01T15:57:52.240

TPEP2 0 Again, the interconnectivity with RM13004 is critical. We get to RM13006 in the next slides.
Teti, Peter E , 2022-12-01T18:00:08.953

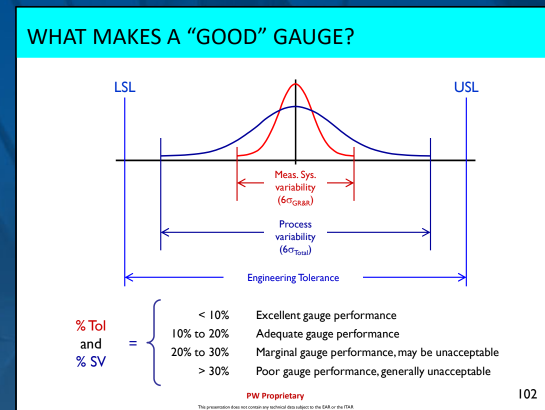
RED FLAGS

MEASUREMENT SYSTEMS ANALYSIS – RM13003

SAP0

Gage Capability Study has unacceptable percent-to-tolerance ratio (> 20%) with no containment plan or corrective action plan in place (i.e., guard banding, new gage on order, calibrating operator methods)

Attribute AbA study conducted with only good parts when nonconforming parts are required in the sample used



CONTROL PLAN – RM13004

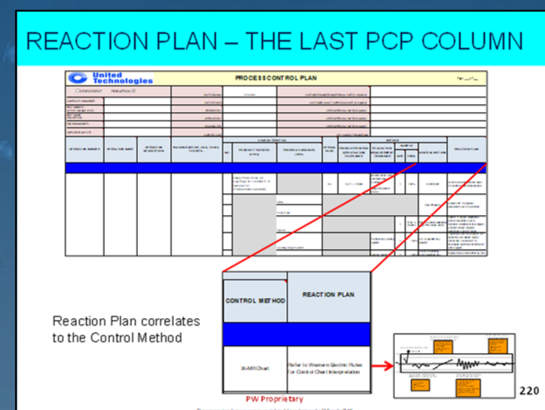
Reaction Plans geared to the generation of non-conforming/out of tolerance features only

Reaction Plans do no align to the established control method or reflect RM13006

Control Plan only addresses KCs but does not account for all high risks and/or process variation

Control Plan does not address Customer KC's nor Suppler self-selected KC's

Operator work instructions lack alignment with Control Plan



Slide 25

SAP0 Again not RM13006
Stout, Andrew PWC, 2022-12-01T15:58:31.064

TPEP0 0 Again, interconnectivity with other RM's. Part of the objective here.
Teti, Peter E , 2022-12-01T18:00:37.343

SAP0

RED FLAGS

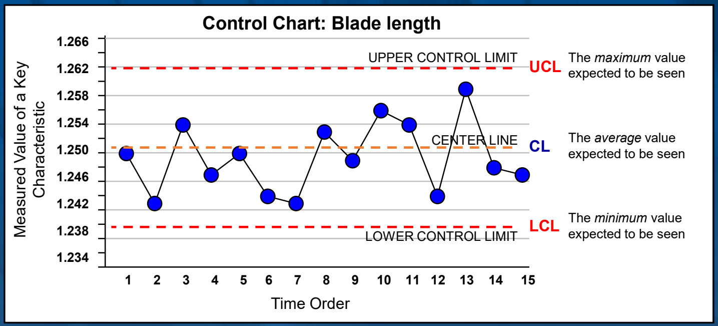
SPC CONTROL CHART AND CAPABILITY STUDIES – RM13006

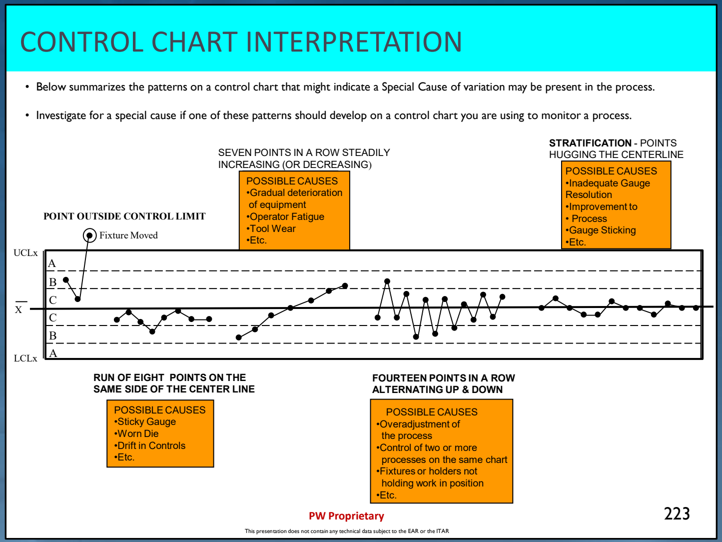
Control Charts are not in place at transformation operation

No evidence operators are trained in use of control charts or the Western Electric Rules

Data collected at transformation operation but analysis done separately for the purpose of satisfying Customer reporting or PPAP submission

General SPC resistance as described in RM13006, Section 12.3.





Slide 26

SAP0 Consider adding something from section 12.3 Resistance to SPC
Stout, Andrew PWC, 2022-12-01T16:00:40.813

TPEP0 0 Added
Teti, Peter E , 2022-12-01T18:01:38.479

SUMMARY AND CLOSE

PETER E. TETI
FELLOW, QUALITY ENGINEERING
PRATT AND WHITNEY

FUTURE WEBINARS

From the Process Control Methods SMIG Group

Look for these future topics in the "Upcoming Events" page on the AESQ website:

https://aesq.sae-itc.com/interest-groups

NO.	FUTURE WEBINAR TOPICS	TARGET DATE/TIME	WEBINAR LEAD	SUPPORTING SUB-TEAM	BRIEF DESCRIPTION
1	Process Control Methods - What is RM13006? Interaction with other AESQ Reference Manuals	12/6/2022 (11 AM US Eastern)	Pete Teti	Nicklas Godebu/Marnie Ham/Geoffrey Carpentier	Overview of RM13006 and how it interacts with other AS13100 reference manuals.
2	What makes a good Process Capability Study?	1/26/2023 (11 AM U.S. Eastern)	Steve Hampton	Marnie Ham/Karen Scavotto/Geoffrey Carpentier	Cpk values are only as good as what goes into the data used to calculate Cpk, such as the adequacy of the measurement system and achieving statistical control.
3	Process Capability Study for True Position (handling MMC)	2/8/2023 (11 AM U.S. Eastern)	Grant Braun	Karen Scavotto/Marnie Ham/Shailesh Shinde/Andrew Stout	How do we handle process capability for one-sided or unlateral tolerances such as true position where Maximum Material Condition modifiers may play a role?
4	The use of non-statistically based process control methods	2/15/2023 (11 AM U.S. Eastern)	Paul Gorg	Pete Teti/Earl Capozzi/Rudi Braunieder/Nicklas Godebu	Process controls need not only be statistically based. Here we explore non-statistical methods such as error-proofing devices, the PreControl method, and the use of run charts with non statistical limts.
5	The Power of Precontrol	3/8/2023 (11 AM U.S. Eastern)	Pete Teti	Andrew Stout/Steve Hampton	PreControl is a powerpul non-statistical tool that is easy to get up and running with that can be used to qualify the set-up of a lot as well as a control for the production run.
6	The One-Hour Process Control Assessment	4/11/2023 (11 AM U.S. Eastern)	Pete Teti	TBD	If you were visiting a supplier and only had time to carve out one hour for a process control assessment, what questions would you ask and where whom would you ask those questions to?
7	Why is statistical control a prerequisite for process capability?	Target 2nd Qtr (May)	Marnie Ham	Andrew Stout/Geoffrey Carpentier/Douglas Dush	Process Capability indexes without the use of SPC Control Charts are invalid. Control Charts are the method to monitor and control a process and are a key prerequisite prior to calculating Cp & Cpk.
8	Dealing with Non-Normal Data	Target 2nd Qtr (June)	Karen Scavotto	Marnie Ham/Shailesh Shinde/Andrew Stout	What happens when the data coming from a process is non-normal? What can be done to accuratly assess process capability? We will show you!
9	Conducting capability studies for one-sided geometric tolerances	Target 3rd Qtr (July)	Karen Scavotto	Marnie Ham/Shailesh Shinde/Andrew Stout	Aerospace component manufacturers the world over deal with geometric/one-sided features such as runout, flatness, etc. What rules have to change when assessing process capability?

Q & A SESSION

USE THE "CHAT" FUNCTION TO ASK A QUESTION…

SUMMARY

All resources will be available on the AESQ website within a few days.

An email will be sent to all registrants with a link.

THANK YOU FOR PARTICIPATING